

Making NASA Earth Observing System Satellite Data Accessible to the K-12 and Citizen Scientist Communities

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Abstract—The Atmospheric Sciences Data Center (ASDC) at NASA's Langley Research Center houses over 700 data sets related to Earth's radiation budget, clouds, aerosols and tropospheric chemistry. These data sets are produced to increase academic understanding of the natural and anthropogenic perturbations that influence global climate change. The "Mentoring and inquiry using NASA Data on Atmospheric and earth science for Teachers and Amateurs" (MY NASA DATA) project has been established to systematically support educational activities at all levels of formal and informal education by reducing these large data holdings to 'microsets' that will be easily explored and understood by the K-12 and the amateur scientist communities

Keywords—*datasets; educational outreach*

I. INTRODUCTION

The Atmospheric Sciences Data Center (ASDC) at NASA's Langley Research Center houses over 700 data sets related to Earth's radiation budget, clouds, aerosols and tropospheric chemistry. These data sets are produced to increase academic understanding of the natural and anthropogenic perturbations that influence global climate change. The "Mentoring and inquiry using NASA Data on Atmospheric and earth science for Teachers and Amateurs" (MY NASA DATA) project has been established to systematically support educational activities at all levels of formal and informal education by reducing these large data holdings to 'microsets' that will be easily explored and understood by the K-12 and the amateur scientist communities. The project is supported by NASA's Earth Science Enterprise (ESE) under the Research, Education and Applications Solutions Network (REASoN), a distributed network of data and information providers for ESE. The goal of NASA's ESE Education Program is to stimulate public interest in the understanding of Earth system science and to encourage young scholars to consider careers in science and technology.

Microsets developed in this project are being made available on the MY NASA DATA Web site. [1] The Web site also hosts associated lesson plans, computer tools, data information pages, and a science glossary. A future open source component of the Web site will enable practicing teachers or citizen scientists to submit lesson plans or tools that they have created or utilized with the data for sharing with other users. Students and citizen scientists are also encouraged to send any project reports that utilize the MY NASA DATA microsets. Feedback and suggestions are welcome to help us serve public educational needs.

Special MY NASA DATA microsets will also be made in support of NASA's GLOBE [2] project. The GLOBE project has over 14,000 registered school locations that have logged millions of environmental observations since 1995. The MY NASA DATA microsets will correspond to the locations and times of GLOBE student observations of cloud cover, for example. GLOBE schools will then be able to retrieve and visualize Clouds and the Earth's Radiant Energy System (CERES) satellite data, for example, on the GLOBE Web site specifically for their site location. The same microsetting process will be applied to Students' Cloud Observations On Line (S'COOL) site locations. S'COOL currently involves over 1600 schools in 65 countries. [3]

II. EDUCATIONAL APPLICATION

A. Elementary School

Children at elementary school age begin to learn the scientific process through simple inquiry-based activities and begin to learn about the Earth system by observing objects in the sky and patterns of changes in the sky. [4] It is imperative for science teachers of this age group to foster excitement in scientific discovery and understanding. By providing access to age-appropriate lesson plans which incorporate simplified NASA earth satellite data, the MY NASA DATA project can

provide a resource to help elementary school teachers not only address but supplement learning outcomes specified by national and state educational standards. Examples of such lesson plans might be locating satellite-observed data points on a map, observing seasonal and daily changes in temperature or cloud cover, or examining the different surface types of the Earth. In grades K-5, students also gain their initial understanding of “data” by counting, collecting data, and performing simple data analysis.⁵ Children can also begin to learn to use a computer by navigating the MY NASA DATA Web site, performing simple data analysis, such as drawing bar-graphs, and by exploring related links.

B. Middle School

Exploration of the scientific process through inquiry and increasing knowledge of Earth science continues through the middle school years. [4] Concurrently, students are continuing to practice computational, data collecting and analysis, and computer skills.⁵ Thus teachers of this age group could greatly benefit from access to a source real scientific data for use as a teaching strategy. Such key concepts like Earth’s energy budget, cloud formation and atmospheric phenomenon can be particularly well communicated using the simplified MY NASA DATA microsets, computer tools and lesson plans. Additionally, instructions are available for loading the microsets into Microsoft Excel and viewing prepared visualizations of data. The visualization applications will utilize IDL Virtual Machine which may be acquired free of charge from the RSI Web site.³

C. High School

By the end of their high school years, students are expected to demonstrate a deeper understanding of how scientists apply inquiry and the scientific process. [4] Many students become involved in completing a student research project, perhaps to meet a course requirement, but also for enrichment or for participation in science or math competitions or community science activities. The MY NASA DATA Web site will contain ideas and instructions for various science fair projects related to using real-world data.

Students at this level may be enrolled in academic courses with learning outcomes specific to studying Earth systems, such as earth science, environmental science, or astronomy. They may also be introduced to advanced concepts in physics, chemistry, mathematics and computer programming. Many students, in preparing for further education, require introduction to advanced scientific methods and issues. MY NASA DATA can be used to demonstrate and introduce these students to authentic research and data-analysis used by NASA researchers.

II. CITIZEN SCIENTIST APEAL

A separate area on the MY NASA DATA Web site is being created to appeal to amateur scientists. A wide range of scientific interest and skill is expected, so a diverse selection of earth science data and tools are in development. Proposed research topics will be posted on the Web site. Interactive tools

and interfaces to ASDC data holdings will enable users to create custom microsets for specific individual interests. An OPENDAP/DODS server will be utilized to transfer data to the client in the format a client desires. A Web Mapping Service will also be offered to render GIS-formatted data using OpenGIS interoperability standards.

The OPeNDAP server and the WMS will have the capability to access the ASDC Datapool [7], an online cache of recent and most popular data products. Most of this ASDC data is in native HDF-EOS format, but the services will enable a user to reformat and subset the data on-the-fly. Amateur scientists who may not have the computing resources to stage large data files prior to analysis will benefit greatly from this web technology. Additionally, familiar analysis and visualization tools may be used with the data such as IDL, GrADS, Ferret, LAS, MATLAB, or Microsoft Excel. More information regarding OPeNDAP clients is available at the UCAR Web site. [8]

III. OPPORTUNITIES

Sometimes teachers are required to educate their students in science without specific training in certain scientific concepts or educational materials, and often these teachers can spare little time to seek resources to improve their science teaching. National teacher workshops will be held each summer for five years to help teachers learn about incorporating the microsets in their curriculum. The first workshop was held August 4-11, 2004, at NASA Langley Research Center in Hampton, Virginia. Seventeen teachers representing twelve states and Puerto Rico participated. Workshop participants will be asked to provide feedback to make the MY NASA DATA project most effective and user-friendly.

The MY NASA DATA project will also focus upon establishing a mentor network where local citizen scientists can register and be matched to local K-12 teachers to assist with science education inside or outside the classroom.

ACKNOWLEDGMENT

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REFERENCES

- [1] MY NASA DATA <http://mynasadata.larc.nasa.gov>
- [2] GLOBE Project, <http://www.globe.gov>
- [3] R. Sepulveda, Lin H. Chambers, “NASA CERES S’COOL Project: Bridging the Gap between Research and the Classroom”, International Geophysical and Remote Sensing symposium, Anchorage, AD. September, 2004.
- [4] National Science Education Standards. National Research Council, 1996.
- [5] Standards for School Mathematics. National Council of Teachers of Mathematics, Inc., 2000.
- [6] RSI, Inc. <http://www.rsinc.com>

- [7] <http://eosweb.larc.nasa.gov>
- [8] <http://www.unidata.ucar.edu/packages/dods/home/faq/whatClients.html>.